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Odonata collected in Japan, with the descriptions of three new species.
By Lt.-Col. F. C. Fraser, I.M.S. (Retd.) . . . . pp. 141–156

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ODONATA COLLECTED IN JAPAN WITH THE DESCRIPTIONS OF THREE NEW SPECIES

By Lt.-Col. F. C. Fraser, I.M.S. (Retd.).

[Read 4th December, 1935.]

With Seven Text-figures.

I spent the months of May and June 1934 collecting dragonflies (Odonata) in Japan. The trip had been planned some time before, but, owing to my ignorance of the country, no definite route had been made out. Thus I was more or less compelled to find out for myself which were the best places to collect in, and, as most collectors are well aware, much valuable time can be lost in this way by visiting sterile localities needlessly. Viewing the trip in retrospect, I can see now that it would have been better to have made my expedition a little later in the year and also to have spent more time at Kyoto, Nara and their environs, both of which were splendid collecting grounds for the insects of which I was in search. I was fortunate on the whole, however, and although only three new species and the unknown sexes of two other species were discovered, many valuable ecological notes were made and the unknown larva of *Macromia amphigena* Selys was discovered.

After sailing up and enjoying the exquisite beauty of the Inland Sea, I disembarked at Kobe, from which port my tour began. I spent only a day here as it appeared too built up to be of much value for insect life. A visit inland, where the hills rise up steeply, resulted in the capture of a few specimens of *Mnais strigata* only; a few large Aeshnas were seen, probably *Aeschnophlebia*, but were too inaccessible to capture. Small streams are numerous on the face of this escarpment, but, being so steep, they are only full when in spate. The hills themselves, as elsewhere in Japan, are heavily forested with *Azalea*, offering plenty of shelter for insect life. From Kobe, I went to Kyoto, which place I made my headquarters for a few days. The country around this fine city is ideal for collecting, and the large preserves at Arashiyama form a natural sanctuary for all kinds of insects. Dragonflies were in great abundance, but most species were just emerging and were more or less useless as specimens. From Kobe I made short trips to Nara and Hodzu, the former place being situate in fine park-like country, hilly, well wooded and watered and especially adapted for dragonfly life. Leaving Kyoto, I went via Tokyo to Nikko, a small hill station of about 3000 to 4000 ft. I found only one good hunting ground here and that unfortunately only on the day before I left. Chuzenji, which I visited from Nikko, is about 6000 ft. above sea-level and, at that time of the year, was not only very wet but bitterly cold, the snow-line being in close proximity, thus no signs of insect life were found there. A few weeks later in the year it would be probably a fine locality for the larger dragonflies such as *Aeshna*.

From Nikko I went via Tokyo and Yokohama to Myanoshita, another hill station, drier and warmer than Nikko and far more productive of insects of all kinds, especially Lepidoptera; *Papilio* spp. and *Colias* spp. being especially common. Heavy jungle covers the hills but large areas of open

grass uplands occupy the valleys, and there is a fine lake at Hakone a few miles off. A flying visit to Atami was made from Myanoshita, but was quite unproductive as no streams or ponds were found. Leaving Myanoshita I went to Tokyo, where I had the pleasure of meeting Professor Matsumura, who very kindly took me out to Irokashira, a country suburb of Tokyo. Here I met Mr. Harima, an entomologist of repute, from whom I was able to obtain some valuable material. My tour ended at Yokohama, at which port the only good hunting ground was found at Sankai-en Park, a private garden open to the public, which contains a fine lake heavily overgrown with rushes and water-lilies and ideal as a breeding ground for Odonata.

My stay in the islands was rendered more pleasant and profitable by the kindness and courtesy of the few Japanese friends and acquaintances I made and of whom I cannot speak too highly.

Suborder—Zygoptera.

1. *Copera annulata* (Selys).

Not uncommon at Nara, Irokashira, Mitakamura and Yokohama along the margins of the lake at the former two localities and in damp weedy ditches in the latter. The males differ from type in having segments 9 and 10 entirely blue and the anal appendages entirely white save for the extreme apex beneath. The females are true to type. At Irokashira they were in company with *Platycnemis foliacea* in the long grass which borders a long serpentine pond with heavily wooded surroundings. Females were found hiding under surrounding scrub.

2. *Platycnemis foliacea* Selys.

Found only around the borders of the above-mentioned pond at Irokashira, where they were in great numbers. A less retiring insect than the last and very local in distribution.

3. *Coenagrion sieboldii* Selys.

The commonest and most widely distributed species of *Coenagrion* in Japan. I found it on all ponds, but more especially on the lakes at Nara, Irokashira and Sankai-en, Yokohama. It has a habit of resting flat on the floating water-lily leaves, a habit shared by *C. dyeri* in India. In such spots it was difficult to take it without wetting one's net, and it was probably equally difficult for the larger dragonflies, which prey on it, to seize it in such a position. Although several species have been reported from Japan, this was the only species which I came across.

4. *Agrion cornelia* Selys.

This species was seen in fair numbers on all streams at Kyoto, but were mostly subadult. They flew beside the streams and invaded the smaller tributaries, settling on floating logs or perching on prominent objects in the bed of the streams. At Myanoshita, although at a greater altitude, all specimens were fully adult, a circumstance very hard to explain. Here they were found only in the bed of the deep precipitous ravine and, by reason of their dark-coloured wings, formed conspicuous objects even from a long distance as they perched on the tops of boulders. They engaged in long irregular flights, often fighting each other fiercely as they met en route. They are shy, wary

insects and required careful stalking, which was rendered the more difficult by reason of the rugged nature of their haunts. Most specimens were taken during their frequent combats, when their attention was distracted; their flight is clumsy, flapping and very zigzagged.

Some few differences are to be noted between these specimens and the original description of the species. The prothorax and synthorax are a fiery coppery-bronze very similar to that found in *C. haemorrhoidalis*; the spots on the vertex are absent; the underside of the synthorax, the lower part of the sides and two fine lines on the humeral and postero-lateral sutures are pale ochreous or carneous. Finally, there is a black spot shaped like an hour-glass on the underside of the thorax.

In the female the labrum is bright yellow narrowly bordered with black and nearly bisected by a short tongue of the same colour.

♂, abdomen 61 mm.; hind-wing 48 mm. ♀, abdomen 54 mm.; hind-wing 50 mm.

5. *Agrion japonica* Selys.

A moderately common species at Kyoto, especially on the smaller streams. It was also present in smaller numbers at Irokashira and Atami. It is a much more retiring insect than *A. cornelia* and most specimens were taken in the forest bordering streams, where it was found settled on foliage, often high up in the trees. Failure to secure a specimen at the first attempt resulted in the insect rising until far out of reach.

6. *Mnais strigata* Selys.

This is the commonest species of the genus found in Japan and is found on nearly every stream. I took specimens at Kobe, Kyoto, Nara, Nikko and Myanoshita, it being equally common at all altitudes. At Kobe it was particularly frequent around the mouths of all culverts on steep precipitous streams and, when pursued, specimens at once took refuge within the precincts of the culverts. At Nikko, it positively swarmed in a marsh, and six or more specimens could be taken at every sweep of the net. At Kobe, most specimens were females and all adult, whilst at Nikko, both sexes were equally common and nearly all teneral. A few isolated, adult, partially pruinosed specimens were found in the ravine at Myanoshita. Their habits are a close parallel to *Vestalis*.

7. *Mnais costalis* Selys.

A more conspicuous but far less common species than the last, of which two distinct forms were taken. The first of these, a very robust insect with opaque costal band of medium length and breadth was taken at Kyoto. Only three males were secured, as the insects kept well out in the stream resting on rafts of logs which were being floated down-stream to the timber yards. Only occasionally would one approach the bank of the river and even more rarely did they penetrate the subsidiary streams. This same form was seen again in the ravine at Myanoshita, but owing to its wariness and the precipitous nature of the habitat was even more difficult to take. Their flight is strong and swift but more after the nature of a swift butterfly than the whirring flight of a dragonfly. The second form, which was found in a marsh at Nikko, amongst dense, tall scrub were subteneral and had a weak fluttering flight, a much less robust body and a longer and broader costal opaque band.

Kyoto and Myanoshita form.—♂, abdomen 43–49 mm.; hind-wing 37–40 mm.; pterostigma elongate, at least three times as long as broad and followed distally by 2 rows

of cells. The opaque costal band extending from node to half-way to pterostigma or in some, nearly to that organ and about 8 to 9 cells deep at its greatest breadth.

Nikko form.—♂, abdomen 40–45 mm.; hind-wing 36–38 mm.; pterostigma shorter and more quadrate, followed also by 2 rows of cells; costal opaque band much longer, beginning about 11 cells proximal to node and extending nearly up to pterostigma, and 11 cells deep at its greatest breadth.

I have seen two other forms in which the costal band is only one cell deep, or nearly obsolete in one, and four to five cells deep in the other, in which it extends well proximal to the node. In the first of these the pterostigma is elongate, covering 6 to 7 cells, whilst in the latter it is shorter and covers only 4 to 5 cells. How far these different forms are related, it is difficult to say, but after examining a large number of specimens in the British Museum, MacLachlan and Morton collections as well as in my own, I am unable to find a graduated series. The several forms are not found in the same localities, so that it would appear best to regard them as very distinct varieties which are taking on subspecific rank.

8. *Aeschnophlebia longistigma* Selys (= *A. optata* Selys and *A. anisoptera* Selys).

After examining a series of specimens of this species, of which I took 16 males and 3 females at Sankai-en, Yokohama, and comparing the notes made at the time, on the living colours and markings with those now exhibited and changed by postmortem decomposition, I have come to the conclusion that all the Selysian names actually belong to but one species. Selys described two of his species from females only and was not aware that the pterostigma is generally longer in that sex than in the male. As regards the markings and the colour of the back of the head, all these are exhibited in my series now, although they were not present when alive. The facial markings vary also within limits and the occipital triangle may be yellow or black. The following notes were made on the living colours :—

Face bright pale green marked with black as follows:—anterior border of labrum narrowly, anteclypeus and lower border of postclypeus, a narrow transverse stripe at junction of latter with anterior surface of frons of variable width, the crest of the frons, this sometimes meeting the anterior transverse stripe on each side to enclose an oval of green, the base of the frons very broadly, a tail running forward from this medially to join the black on crest so as to form a black capital T, the vesicle which has the two-pointed apex yellow, the eyes behind very finely black, this encroaching on the occiput which is usually yellow. Behind eyes greyish-white, not yellow (this often mottled or entirely black after death). Eyes bottle green. Thorax pea-green with median and antehumeral black stripes, the latter broad and squared above, incomplete and pointed below; laterally the sutures very finely black. Legs black or the two hind pairs marked with ferruginous or greenish-yellow on the extensor surface; all three pairs in the ♀ ferruginous. Wings palely tinted, sometimes enfumed at apices and markedly tinted with yellow in the female especially along the costal areas of wings; pterostigma elongate in all wings but usually distinctly longer in the ♀; subcostal nervure variably prolonged, usually only in the fore-wings but occasionally in the hind also, in one or both of these. In some it ends proximal to the first postnodal nervure, ending in mid-wing or on the costa or radius, whilst in others it is prolonged to the second postnodal. Abdomen black and bluish green, the latter preponderating; two very broad subdorsal black stripes extending

the whole length of abdomen enclosing a medial dorsal stripe which gradually narrows from base to apex of abdomen; on segments 2 and 3 the jugal suture is finely bluish-green, dividing or interrupting the black stripe, and on segments 4, 5 and 6, this same marking is represented by small paired isolated subdorsal subbasal spots; finally the bluish ground-colour forms fine basal annules on segments 3 to 8 and paired small apical spots on segments 8 to 10, being usually confluent on the latter. Anal appendages black, superiors variable but usually resembling those shown for *A. optata* in Martin's monograph (*Cat. Coll. Selys*, Aeschnines : 139). ♀ ovipositor large and robust followed on the ventral surface of segment 10 by a well-developed dentigerous plate clothed by numerous robust spines.

Habitat.—My specimens were obtained at one corner of the lake in Sankai-en Park, where the water was entirely hidden by dense bulrushes. In these the females were busy ovipositing, and males, in great numbers, flew low over the rushes or penetrated them in search of females; the rustling of their wings made a subdued continuous rustle. All my specimens were taken in a very short space of time and their number was entirely limited by the capacity of my receptacles, otherwise I could have taken a hundred or more.

9. *Planaeschna milnei* (Selys).

The male of this species has not been described previously; the type is a female in the MacLachlan collection and appears to be unique. I have a single male from Hirooka, Tosa, of which the description follows :—

♂, abdomen 54 mm.; hind-wing 46 mm.

Head : labium citron yellow; labrum pale yellow heavily bordered anteriorly, narrowly so at base and finely medially bisected with black; anteclypeus dark brown; postclypeus bright citron yellow very finely bordered with black below but broadly and squarely so at the middle; frons prow-shaped, very deep anteriorly, black with a narrow citron yellow stripe on each side which runs upwards and is gradually lost above; vertex and occiput black; eyes dark brown. Prothorax blackish-brown, posterior lobe large and fringed with long dark brown hairs; thorax black on dorsum marked by narrow citron yellow antehumeral stripes shaped like the blade of a penknife, the point directed below and outwards; laterally bright citron yellow with a very broad medial black stripe and a narrow bordering of black posteriorly. Legs black except the anterior pair of femora which are yellow below in the basal half. Wings hyaline; membrane narrow, pure white; pterostigma rather short, covering 4 to 5 cells, braced, blackish brown; nodal index $\frac{17\text{–}23 \mid 22\text{–}17}{18\text{–}18 \mid 18\text{–}17}$; anal-triangle 3 to 4 celled; base of hind-wing nearly straight, markedly thickened, tornus right-angled; anal-loop subquadrate, 6 to 8 celled; discoidal triangles 3 celled, of equal length but that of hind-wing the broader; arc situated midway between the two primary antenodal nervures and not far removed from the base of discoidal triangles; 4 to 5 cubital nervures in all wings. Abdomen slightly tumid at base, very markedly constricted at segment 3, thereafter, narrow and parallel sides to the end, black with narrow citron yellow annules on middorsum of segments 2 to 8, markedly broken on the former segment, very finely divided on the others; segment 1 with two small dorsal spots adjoining a brownish hairy area; segment 9 unmarked; segment 10 with two large triangular yellow spots on dorsum. Anal appendages : superiors twice the length of segment 10, sweeping strongly downwards and backwards and abruptly dilated at apex as seen in profile; seen from above, gradually converging, narrow at base and gradually broadening towards apices which end in a minute point and are strongly keeled above.

Inferior slightly more than half the length of superiors, triangular, apex minutely emarginate and slightly upturned. Oreillets on segment 2 very large, broadly citron yellow margined behind with black where are seen some 10 black robust spines.

Martin places this species in *Austroaeschna*, but I prefer to retain Forster's genus giving as extra characters the elevated pointed frons and the markedly constricted segment 3 which is reminiscent more of *Gynacantha* than *Aeshna*. Failing this, it would be better to retain it in *Aeshna*. On the wing this species might well be mistaken for *Cordulegaster annulatus* or a species of *Macromia*, so unlike is the colour scheme of black and bright yellow to what is found in *Aeshna*.

10. *Boyeria maclachlani* Selys.

A single female from Honshu differing only from the type, in the MacLachlan collection, by its larger size—abdomen 64 mm.; hind-wing 55 mm. A very rare species of which only 3 males and 2 females have so far been recorded.

11. *Tanypteryx pryeri* (Selys).

A single pair of this archaic species was taken alongside the river at Kyoto. The male was fully adult and was taken resting flat on a rock a few inches from where my wife was sitting. The female, not quite fully adult, was taken resting on the trunk of a tree with its wings folded over its back like a Zygopteron. I first saw it flying and followed it up a small ravine whilst it hawked at a low level over the long grass and herbage, finally settling on the tree where I captured it. I think that I saw other specimens flying rather high up, but there were so many *Gomphus melaenops* on the wing, which looked very similar in flight, that I could not be certain. Very few specimens of this rare species are known, and its larva remains to be discovered. The river and ravine opening into it at this spot were densely clothed with forest through which small streams and numerous seepages meander, so that it may breed in these.

12. *Gomphus melaenops* Selys.

Eleven males and four females of this fine species were obtained at Kyoto by the side of the river and up a small creek which ran in a deep gully opening on to the main stream. Most were flying rather wildly about the entrance to this miniature valley, but others were found resting on bushes like *G. personatus* to which the species appears to be closely related. If I could have given them undivided attention, I could have taken great numbers, for they were quite numerous. They were quite the most numerous dragonfly seen, and this for a species of *Gomphus* is unique in all my long and varied experience.

All specimens are true to type and variation is practically absent; the males sometimes exhibit a vestigial occipital spine corresponding to the robust spine seen in the female.

13. *Gomphus postocularis* Selys.

Only a single pair of this fine species was taken, and this in the same locality as the foregoing species on 22.v.34. They flew along the banks of the main stream, settling on boats and rafts, often well out in the stream and but rarely on the foreshore where I took my only two. In its habits and structure, as well as markings, it is remarkably similar to *Gomphus vulgatissimus*, to which it must be very closely related.

14. **Gomphus fujiacus** sp. n. (fig. 7).

♂, abdomen 29 mm.; hind-wing 25 mm.

Head and prothorax similar to *melampus* except the occiput, which exhibits no yellow spot behind: the yellow spot on vertex is present, however. Thorax black on dorsum with greenish-yellow markings as follows:—short fusiform divergent antehumeral stripes widely separated from the mesothoracic collar which is broadly confluent medially and prolonged up the middorsal carina finely as far as the antealar sinus; obscure vestiges of an upper humeral spot but no stripe. Laterally broadly yellow with a very thick median oblique black stripe broadened at the spiracle; black beneath. Legs black; abdomen black, marked similarly to *G. melampus* but the markings restricted to the three basal segments and the trilobate middorsal marking on segment 2 tapered markedly towards the apex.

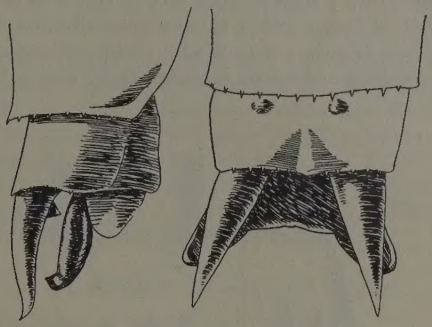

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Fig. 7.—Anal appendages of *Gomphus fujiacus* sp. n. ♂, right lateral and dorsal views.

Wings with reticulation more open; only 3 cells in anal triangle; hypertrigone markedly quadrate distally as in *Merogomphus*; 13 antenodal and postnodal nervures in fore-wings, 8–9 antenodal and 12 postnodal nervures in the hind; *Cuii* and *IA* remarkably divergent at wing border, 8 cells between their distal ends. Anal appendages black: superiors half as long again as segment 10, conical, very slightly divergent, furnished with a robust, sharply defined tooth on the ventral surface at extreme base of appendage and not visible when the appendage is viewed from above; no external tooth on outer border as seen in *G. melampus*. Inferior appendage with branches slightly more divergent than superiors, directed straight back and with a robust tooth on the upper surface of each at extreme apex.

Habitat.—Japan: Nikko. The type, in my own collection, was taken in a marsh amidst long grass and scrub jungle. This species is easily distinguished from all others of the *melampus* group by the ventro-basal tooth on the superior appendages; by the widely divergent character of *Cuii* and *IA* in the hind-wings and finally by the antehumeral stripe widely separated from the meso-thoracic collar.

It is to be noted that Selys described *G. melampus* as having six black stripes on the thorax, the two anterior dorsal ones confluent; actually the two latter form one thick black area and not a stripe, so that it would be better to describe the thorax as black on dorsum with broad yellow antehumeral stripes confluent with the mesothoracic collar, and narrow yellow interrupted humeral stripes

to their outer side. *G. unifasciatus* Oguma, which I have received from Mr. Teuchi Okumara, turns out to be synonymous with *G. melampus*.

15. **Gomphus chichibui** sp. n. (fig. 1).

♂, abdomen 35 mm.; hind-wing 25 mm. (♀ unknown.)

Head: labium matt black; labrum, bases of mandibles and genae pale greenish-white, the former moderately broadly bordered with black; anteclypeus black; postclypeus and frons pale greenish-white with a broad transverse black stripe at level of the suture between the two and continuous laterally with a broad black basal border on upper surface of frons; eyes bottle-green during life; vertex and occiput black, the former with a small oval central yellow spot; occiput simple, almost straight and fringed with long black hairs. Prothorax black with a large rounded spot on each side of middle lobe, a small geminate spot in middle of dorsum and an anterior collar all citron yellow. Thorax black on dorsum, citron yellow laterally; dorsum with broad antehumeral stripes broadening below as in *G. vulgatissimus* and nearly confluent there, converging above; an upper

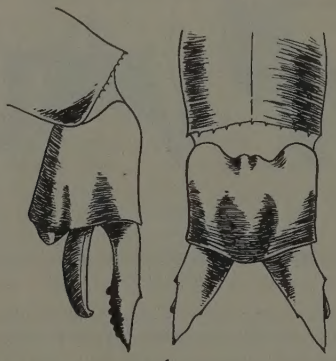

Fig. 1.—Anal appendages of *Gomphus chichibui* sp. n. ♂, left lateral and dorsal views.

humeral spot which is rather widely separated from a short humeral stripe. Laterally two narrow black stripes, the anterior interrupted at its middle and broadening below where it covers the spiracle. Black beneath. Legs entirely black; hind femora extending to middle of segment 2 and furnished with numerous closely-set minute spines. Wings palely tinted with yellow at base; pterostigma yellow between thick black nervures, braced, equal in length to one-third of the distance between itself and node, that of hind-wing distinctly larger than that of fore-wing; nodal index $\frac{12\text{–}12 \mid 13\text{–}11}{10\text{–}\ 9 \mid\ 9\text{–}10}$; discoidal triangles entire, shaped as in *G. vulgatissimus*; anal triangle 5-celled; base of hind-wing sinuous, tornus produced; *IA* pectinate in fore-wing; *Cuii* and *IA* divergent in hind-wing; only one transverse nervure between sectors of arc in the hind-wing but 3–4 in the fore-wing. Abdomen rather long and very slender, segments 1 to base of 3 rather tumid, 8 and 9 a little dilated at the sides, remaining segments slim and cylindrical; black marked with citron yellow as follows:—segment 1 broadly yellow, only its base on dorsum and a narrow lateral stripe black; segment 2 with a fine middorsal line which is abruptly swollen into a large medial round spot, whilst laterally the oreillets lie in a yellow area and are followed

apically by a broad apical spot; segment 3 with a narrow middorsal stripe constricted at the jugal suture and again near apical end of segment, whilst laterally there is a broad stripe which tapers as far as end of segment; segments 4 to 7 with a middorsal stripe, broad at base of segments but tapered to a fine line almost immediately; laterally a large basolateral spot; segment 8 with a basolateral spot and a small triangular apicolateral spot; segment 9 with its borders narrowly yellow. Anal appendages: superiors palest yellow, black beneath, conical, acuminate at end, with a small lateral subbasal spine and a smaller postmedial dorsal spine; these appendages nearly as long as segment 10, slightly divergent. Inferior appendage black, with long divergent branches tapering to an upturned point. Genitalia: lamina small, hood-shaped, its border fringed with long hairs; anterior hamules narrow, very long, compressed and strongly angulated inwards at middle; posterior hamules very robust, foliate, excavate, with a broad robust inner tooth at apex, outer surface yellow and studded with minute black tubercles; lobe large, projecting, its lip deeply emarginate and each lobe again emarginate.

Habitat.—Japan: Nikko, *ca.* 3000 ft. The type, in my own collection, was taken in a marsh amidst low scrub, 3.vi.34. It is easily determined from other species of the genus by the shape and armature of its superior anal appendages and by its genitalia. Venationally, compared with the genotype *Gomphus vulgatissimus*, it is a true *Gomphus*, but it differs strikingly by its rather long and very slender abdomen. Generally it is a small, slenderly built species reminding one of a species of *Burmagomphus* from which, however, it is separated by its venational details.

16. *Nihonogomphus viridis* Okuma.*

♀, abdomen 42–44 mm.; hind-wing 37–39 mm.

Head: labium dark brown; labrum black traversed by a narrow yellow transverse or bow-shaped stripe which is nearly bisected medially by a short tongue of black; bases of mandibles and rest of face and frons bright citron yellow with the suture between ante- and postclypeus narrowly black each side; frons broadly bordered with black at base above; vertex black; occiput broad, rounded, bright citron yellow fringed with long black hairs; eyes bottle-green. Prothorax black marked with citron yellow as follows:—a large pyriform spot on each side followed by a smaller one lower down, a round spot on middorsum of middle lobe which is continued posteriorly as a fine line on to posterior lobe. Thorax black on dorsum, bright citron yellow laterally, marked here by a fine black line only on the posterolateral suture and a similar one on the lower part of anterior suture which ends at the spiracle. Dorsum almost covered by two very broad antehumeral stripes with nearly parallel sides and parallel to one another, the lower ends produced inwards and nearly meeting; the middorsal carina finely yellow at its central lower portion. Legs black, coxae and trochanters with large yellow spots; hind femora extending back as far as apical end of segment 1. Wings hyaline but palely and evenly enfumed and strongly tinted with amber yellow, this colour gradually fading as far as node and especially evident along costal area; pterostigma long and slightly swollen, covering 6

* In M. Murakoshi's *Japanese Insects*, p. 394, fig. 37, a Gomphine indicated as *Gomphus postocularis*, male, is evidently really *Nihonogomphus viridis*, as the markings agree with the latter and not at all with the former. In the same work, p. 397, fig. 47, a *Gomphus* shown as *Nihonogomphus viridis* is actually *Gomphus postocularis*.

Needham, 1930, *Trans. nat. Hist. Soc. Formosa*, **20**: 71, gives *Nihonogomphus* as a synonym for *Ophiogomphus*. He is in error in this since *Nihonogomphus* has not even a vestige of an anal-loop in the hind-wing; on the contrary, the genus is very closely related to *Gomphus* sens. strict., and does not differ from it venationally.

cells, braced, ochreous between black nervures; nodal index $\frac{12-16 \mid 18-13}{12-13 \mid 11-10}$; other venational details as for *Gomphus vulgatissimus*. Abdomen black marked with citron yellow as follows:—segment 1 with the sides broadly and a triangular middorsal spot continued as a fine line as far as base of segment; segment 2 with a broad trilobate middorsal stripe and the sides very broadly; segment 3 somewhat similar but the trilobate dorsal stripe narrower and tapered to apex of segment which it just fails to reach; laterally a long tapering stripe extending nearly to apical border; segments 4 to 7 with a pair of basal lunules and a long fusiform narrow middorsal spot which on 4 and 5 is narrowly confluent with the basal lunules and on 6 and 7 is reduced to a fine line or broken up into two or more spots; laterally each of these segments has an elongate oval spot at the middle of sides; segments 8 and 9 with a short subapical middorsal linear spot and the lower part of sides which are a little dilated; segment 10 yellow, its base narrowly black. Anal appendages rather long, longer than segment 10, conical, yellow; vulvar scale short, about one-third the length of segment 9, triangular with broad blunt apex, preceded by a triangular eminence and followed by a thin raised triangular ridge.

Distribution.—Japan: Kyoto, May. Allotype ♀ in my own collection. Three females taken in company with *G. melanops*, for which I at first mistook them. Easily distinguished by the broad parallel dorsal yellow stripes and almost immaculate thoracic sides. It is regrettable that I failed to take the male, without which it is impossible to place the species with certainty. It belongs, however, to the *personatus* group of genus *Gomphus* and agrees in its venation with that of the genotype.

17. **Davidius fujiama** sp. n. (fig. 2).

♂, abdomen 35 mm.; hind-wing 28 mm.

Head: labium, labrum and face black; postclypeus paler or dark brown; bases of mandibles greenish-yellow; frons with a very broad greenish-yellow stripe which broadly

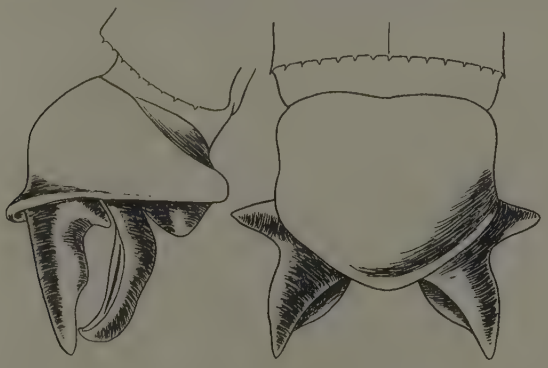

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Fig. 2.—Anal appendages of *Davidius fujiama* sp. n. ♂, right lateral and dorsal views.

overlaps the crest and is bordered posteriorly with black; vertex and occiput black, the latter simple, straight and fringed with long blackish hairs; eyes bottle-green during life. Prothorax black with a very broad golden-yellow anterior collar. Thorax black on

dorsum, bright golden-yellow laterally. A narrow mesothoracic collar complete medially and well separated from short fusiform antehumeral stripes which fall well short of the antealar sinus and converge strongly above; lastly a small upper humeral spot each side of dorsum. Laterally two narrow parallel black stripes close together and broadly confluent below with each other and the black of underside of thorax; finally the extreme posterior corner of thorax black laterally. Legs entirely black; hind femora extending to just apical of the oreillets. Wings palely tinted with yellow at base; pterostigma short, swollen, that of fore-wing the smaller, dark ochreous between thick black nervures; nodal index $\frac{11\text{–}13 \mid 13\text{–}11}{9\text{–}10 \mid 10\text{–}\ 0}$; anal-triangle 3-celled; base of hind-wing very deeply excavate beyond anal-triangle, very sinuous, the tornus produced; discoidal triangle of fore-wing entire, that of the hind traversed once; *Cuii* and *IA* widely divergent in hind-wing. Abdomen black, segments 1 to 3 marked with yellow, others immaculate; segment 1 with a small medial spot on dorsum and larger lateral spot, segment 2 with a trilobate narrow middorsal stripe, the oreillets and a small apicolateral spot, segment 3 with a small basolateral spot. Segment 7 has robust ventro-apical hooks below and 8 has smaller or vestigial hooks of the same character. (The function of these hooks has never been discovered, but undoubtedly they are connected with the action of copulation as they are only present in the ♂.) Anal appendages black: superiors broadly conical, tapering rapidly to an acute point, slightly divergent and furnished on the outer side with a robust spine which projects out at right angles to the long axis of abdomen. Seen from the side, the appendage is strongly bevelled from its middle to apex. Inferior appendage with long curled branches, the ends strongly curled up, divergent and separated by a very broad quadrate notch. Genitalia very similar to that of *D. cuniculus*.

♀, abdomen 33 mm.; hind-wing 28 mm.

A more robust insect than the ♂ but very similar in its markings, differing mainly in the more extensive yellow markings of abdomen. An additional bright yellow spot on each side of the middle lobe of prothorax; posterolateral end of thorax merely lined below with black; wings rather more tinted with yellow at base, pterostigma longer and broader, nodal index $\frac{12\text{–}13 \mid 12\text{–}11}{9\text{–}\ 9 \mid\ 9\text{–}10}$, otherwise venation similar to that of ♂. Abdomen with segment 1 entirely yellow, segment 2 with the trilobate middorsal stripe broader and a broad complete stripe on each side; segments 3 to 6 with a broad lateral stripe which tapers apically on each segment and is narrowly broken on segment 3 by the jugal suture but much more widely interrupted at the same level on the other segments in which it fails to extend to their apical ends; segments 8 and 9 with small subquadrate basolateral spots only; joints between segments 7 to 10 bright yellow. Anal appendages shortly conical, black and separated by a large conical black protuberance. Vulvar scale projecting, half as long as segment 9.

Habitat.—Japan: Nikko, *ca.* 3000 ft. A single pair taken in forest alongside the main stream at Nikko, 3.vi.34. Easily distinguished by the shape of the anal appendages. Type in my own collection.

18. *Davidius cuniculus* Ris (fig. 3).

Eleven specimens of this species were taken, 5 males and a single female at Myanoshita and a single male and 4 females at Nikko. The Myanoshita specimens were taken in a deep gorge resting on stones and rocks in the riverbed, but those from Nikko were all taken resting on trees and bushes on the steep hillside above the stream.

I am inclined to regard *D. cuniculus* as the real *D. ater* Selys, but as the end of the abdomen of the type male and allotype female are both missing, it is impossible to be certain. I note, however, that Ris' description of *D. cuniculus* conforms much more closely to *D. ater* than does that of a female which he redescribes as the female of the latter. More especially is it to be noted that he gave the lateral thoracic stripes as complete in *D. cuniculus* as in *D. ater*, whereas he gave the anterior one of the female of *D. ater* as broadly missing in its upper part. (1916, *Suppl. ent.* **5** : 49, fig. 24.) He also gives a yellow stripe on anteclypeus, whereas the Selysian description states that the face is entirely black.

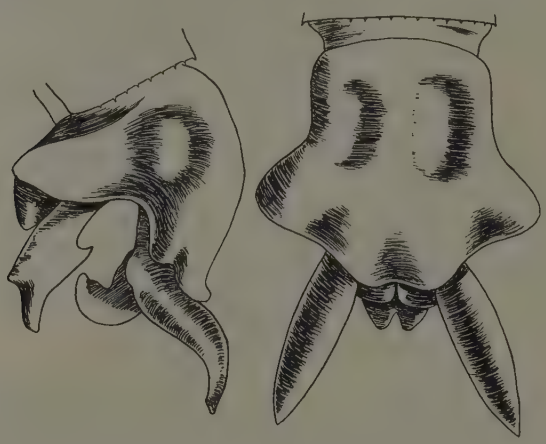

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Fig. 3.—Anal appendages of *Davidius cuniculus* Ris, ♂, left lateral and dorsal views.

Of the series mentioned above, I have made the following notes of the males, determined as *cuniculus* by the shape of their anal appendages.

1. An incomplete basal antenodal nervure is occasionally present in the fore-wings. 2. The discoidal triangles are often complete distally before the end of the hypertrigone so that the latter becomes four-sided as in *Merogomphus*; in others is found the opposite condition so that the triangle shows a marked angulation of its costal side as in *Tetrathemis*. 3. The discoidal triangles of the hind-wings are almost invariably traversed by a nervure running between the costal and distal sides, or between the basal and distal; less commonly one or both triangles in fore-wings are traversed and still less commonly one of the hypertrigones may be traversed. 4. A great variation is found in the nodal index.

9–10	11–9	10–13	13–11,	10–12	12–10
7– 7	7–8	9–10	9–10	9– 8	7–10

5. Very rarely an obscure stripe may be found traversing the anteclypeus. 6. The antehumeral stripes are rarely confluent with the mesothoracic collar. 7. The anterolateral stripe is occasionally interrupted or missing in its upper part (as in the ♀ described by Ris for that of *D. ater*). 8. The occiput is notched at its middle as in *D. ater*.

All of my specimens except one female are adult, and in the latter the facial stripe is well seen and the anterolateral stripe on thorax is markedly broken.

19. *Epophthalmia elegans* Brauer.

Eight males of this fine species were taken flying round the borders of the lake at Nara, where it apparently breeds. No females were seen. Its flight is remarkably swift, but, as it hugs the grassy borders of the lake closely, it was not difficult to take it head on. The specimens do not differ in any way from type.

20. *Macromia amphigena* (Selys) (fig. 4 *a*, *b*).

Selys included this species under genus *Epophthalmia* on account of its traversed discoidal triangles, but this feature is also found in some of the American species of *Macromia*. Any doubts as to its true position have been set at

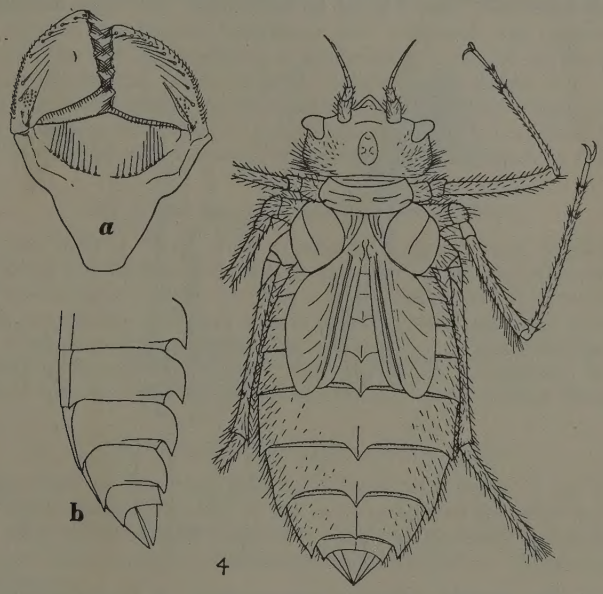

Fig. 4.—Larva of *Macromia amphigena* (Selys). *a*. Labial mask. *b*. Profile view of abdomen showing dorsal spines.

rest, however, by my fortunate discovery of its larva which is found to be a typical *Macromia*. I took a single male of this species in the ravine at Myanoshita, where several others were seen but not taken owing to their swift flight. Near Kyoto, in the compound of a temple, a number of both sexes were seen flying quite low and two pairs were secured with some difficulty. At Kyoto, one male was found emerging on the trunk of a tree, and another exuviae was found on a neighbouring tree. In the latter case, the exuviae was some 6 feet up the tree, which, itself, was perched on a bank 8 feet high, to reach which the larva would have had to climb the river-bank for 4 feet and traverse a 10-foot path, thus entailing a crawl of 28 feet, a remarkable feat for an aquatic larva. The other cast skin from which the imago was emerging was at least 10 feet above the water, but the tree was near the edge of the stream. (For description see fig. 4.) The larva closely resembles that of *M. moorei*

Selys, although slightly larger. The traversed nature of the discoidal triangles is apparently not constant as in *Epophthalmia*, as three specimens, one female and two males, have them entire. Apart from this, all are true to type.

21. *Epitheca marginata* Selys (fig. 5).

One male and two females of this species were taken at Kyoto out of several seen flying. They were hawking along the path beside the river very much after the manner of *P. flavescens*. The footpath was crowded with country folk at the time and the insects seemed quite unperturbed by their presence, although they hampered my efforts to take the insects. They probably breed in the main stream. I did not meet with this species elsewhere in Japan, so that it is regrettable that I failed to take more. The dark marginal costal

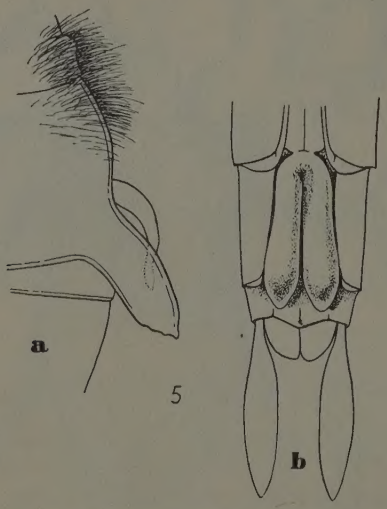

Fig. 5.—*a*. Male genitalia of *Epitheca marginata* Selys. *b*. Female genitalia of same showing enormous ovipositor.

band is not constant as it is only present in one male and one female of my specimens; in the former it is purely vestigial, being represented by short dark spots at the base of the costal and subcostal spaces and by some faint clouding at the node. The unmarked female has not even any vestiges of these markings, whilst in the third specimen the band is well defined, the subcostal space at distal and proximal ends and the costal space to well distal of pterostigma are opaque dark brown, being darkest where it borders the radius. The proximal half of the median space and nearly the whole length of the cubital space are dark brown in the hind-wing, but only the extreme bases of these in the fore-wing. In one specimen the discoidal field of fore-wing has three rows of cells on the right side, but only two rows on the left. The remarkable shape of the ovipositor and the emarginate archaic character of the male inferior anal appendage are shown in fig. 5.

22. *Lyriothemis pachygastra* Selys.

A single male taken at Nara resting on reeds on the bank of a small stream which ran through park-like country. It is a full adult example, not differing from type.

23. *Libellula quadrimaculata* Linn.

A few specimens of this species were seen and captured along the banks of the same stream mentioned for the previous species, and it was seen in greater numbers on the lake at Sankai-en, Yokohama. They do not differ in any way from British examples unless it be that the wing markings are more restricted.

24. *Orthetrum albistyla speciosum* (Uhler).

This was the commonest Libelluline met with and was seen everywhere except at Nikko and Myanoshita; it is obviously a species of the plains and breeds in marshes and small sluggish streams. All stages were met with, from tenerals to full adults, so that emergence goes on for a long period. On the wing it closely resembles *O. cancellatum*, for which I at first mistook it. Contrary to what usually pertains, the majority of specimens seen were females.

25. *Orthetrum japonicum japonicum* (Uhler).

Only met with at Nara where it was in company with *Libellula quadrimaculata* along the borders of a small stream winding through alternate patches of forest and meadow lands. It is a marsh breeder like its near relative in India—*O. japonicum internum*, and is usually found in small colonies over seepages at their emergence from jungle and where it joins the main stream. Superficially it is indistinguishable from the Indian subspecies. Although a submontane species, I was surprised not to find it at Nikko and Myanoshita.

26. *Orthetrum triangulare melania* Selys.

A single male of this magnificent *Orthetrum*, the finest of its genus, was taken at Myanoshita in the bed of the ravine and was the only one seen. It is a fully adult example with bright blue pruinosed abdomen and is larger than any example I have seen of *O. triangulare triangulare* Selys. Abdomen 37 mm.; hind-wing 43 mm.

27. *Deielia phaon* (Selys).

A common species at Nara and Sankai-en, Yokohama, and probably widely distributed over the low country. It breeds in weedy tanks and keeps company with *L. quadrimaculata* and *O. albistyla*. All stages were met with from black and yellow marked specimens to fully pruinosed adults in some of which the thoracic markings were almost completely obscured. On the wing it closely resembles *Brachydiplax sobrina* but is a larger species; its habitats and flight are a close copy of this common S. Asiatic species.

28. *Epiophlebia superstes* (Selys) (fig. 6).

Five males and a single female taken near Kyoto. The habits of the imago and the larva have been described recently by Okumura. As the species is rare and of the greatest interest I give a few notes on my own specimens. In one male, in both hind-wings the arc is reinforced by a buttress

transverse nervure which may be mistaken for the lower part of the arc itself and the latter for a nervure traversing the discoidal cell. Comparing this nervure with the arc in the fore-wings we find that it corresponds exactly with the lower part of that structure, suggesting that the discoidal cell there was at one time an open one. The arc in the fore-wings is strongly angulated

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FIG. 6.—*Epiophlebia superstes* (Selys) at rest, showing the characteristic archaic and Lestine pose. (From a photo by Teüchi Okumura.)

but nearly straight in the hind-wing of all specimens. The vesicle is nearly as broad as the frons and forms an enormous cowl over the central ocellus resembling the hood of a cycle lamp; the lateral ocelli lie behind this cowl deeply sunk in the sulcus between the cowl and the eyes.

This species is an early one, being found only in April and May. When at rest, it holds its wings rather more than half open after the manner of most species of *Lestes*.